springs in a straight line. As for the ether itself, it is to be considered as a substance which may not be an elastic solid, but which, so far as the luminiferous vibrations are concerned, moves as if it were an elastic solid. The lecturer carried on the mathematical discussion of these two dynamical problems — the propagation of waves in an elastic solid, and the motion of a system of spring-connected particles in a straight line — side by side, usually devoting the first half of a lecture to one problem, and the remainder to the other.

It is impossible here to give any specific account of the contents of the lectures; it may be stated, however, that many of the cardinal phenomena of light were shown to be explicable by the hypothesis sketched above, but that the phenomenon of double refraction presented apparently insuperable difficulties, as it has done in all previous attempts to explain it. By proper suppositions regarding the elasticity of the springs (in the mechanical 'model' of the phenomenon given above) double refraction would indeed be produced; but its law would be widely different from that actually observed.

The lecturer was conversational in his manner, made almost no use of notes, and was full of enthusiasm for his subject. The audience was composed of professors of physics from eastern and western colleges, scientific men from Washington, and students and instructors of the Johns Hopkins university. The lectures, while not condensed in form, presupposed thorough familiarity with the physical and mathematical theories involved. A verbatim report of them, from stenographic notes, will be issued in a limited edition, by the use of the papyrograph process. At the close of the course, Sir William Thomson was presented by the class with one of Rowland's concave gratings, as a memento of their connection with him.

## *NORTH-AFRICAN ARCHEOLOGY.*

At a meeting of the Academy of natural sciences of Philadelphia, Sept. 25, Dr. Daniel G. Brinton called attention to a collection of flint-chips collected at the station of Ras-et-Oued, near Biban, on the south-eastern coast of Tunis, and presented to the academy by the Marquis de Nadaillac. The specimens consisted of flint-chips, arrow-points, and a semi-lunar shaped implement of small size, which resembles the 'stemmed scrapers' found in America. This form was obtained from lower levels below the surface, and is characteristic in France of the later productions of the stone age, especially of that epoch called by the French archeologists 'the epoch of Robenhausen,' from the locality of that name in Switzerland. Chronologically this is regarded as the first epoch of the appearance of man on the globe, the previous implement-using animals being probably anthropoids. These made use of stone only, not having learned the dressing of bone or horn. This view adds to the interest of the query as to the purpose of these scrapers. That they were an important tool to the primitive man is evident from their wide distribution. They have been found in France, in the Crimea, in India, in America (both North and South), and now we have them from Africa. The strata in which they have been found are of great antiquity.

The archeology of the North-African coast has especial claims to attention, as from there, apparently, a very ancient migration advanced northward, passing in one direction through Spain, and in another by way of Malta, Sicily, and Italy. This migration was apparently contemporary with the appearance of the Elephas africanus in Europe. Another point of interest, connected with North-African archeology, is found in the fact that the only locality in the old world where animal or effigy mounds have been reported is in Algiers, near the forest of Tenrit-el-Sad, south of Miliana. As these peculiar structures are so frequent in the Mississippi valley, the coincidence is worth noting.

Prof. A. Heilprin contended, that while on the hypothesis of evolution, no objection could be raised to an assumption which made an animal intermediate between man and the anthropoid apes sufficiently intelligent to understand the full value and manufacture of stone implements, such as were exhibited, yet, as a matter of fact, paleontological evidence had thus far failed to prove that any such use or manufacture had been made of them, as was claimed. Indeed, no evidence was forthcoming to show that the implements were not the work of man himself, despite the fact that no traces of human remains have been found associated with the fragments. The assumption that the advent of man dates only to a given period of the so-called 'stone age' was considered to be purely gratuitous, and to rest solely on negative evidence. Many archeologists concur in the belief that man's remains may yet be found in deposits of a strictly tertiary age.

## *THE LIMITATIONS OF SUBMARINE TELEGRAPHY.*[1]

The weight of the conductors, says Henry Vivarez in *La lumière électrique*, plays an important part in submarine telegraphy, not merely as a heavy item in the outlay, but as one of the principal factors in laying down the lines, and in taking them up in case of damage. When the conductor is being raised, the grappling-irons which lift it have to resist not merely the vertical component of the weight of the cable, but also the considerable effects resulting from friction against the water. It thus frequently happens, when working at great depths, that the conductor may be exposed to a strain greater than it is able to bear, and we are forced to have recourse to stratagems to bring it to the surface. These artifices consist in the use of two or more ships in raising, which is done as shown in figs. 2 and 3, or, in the most simple cases,

[1] Reproduced in abridged form from the *Electrical review*, and the cuts from *La lumière électrique*.